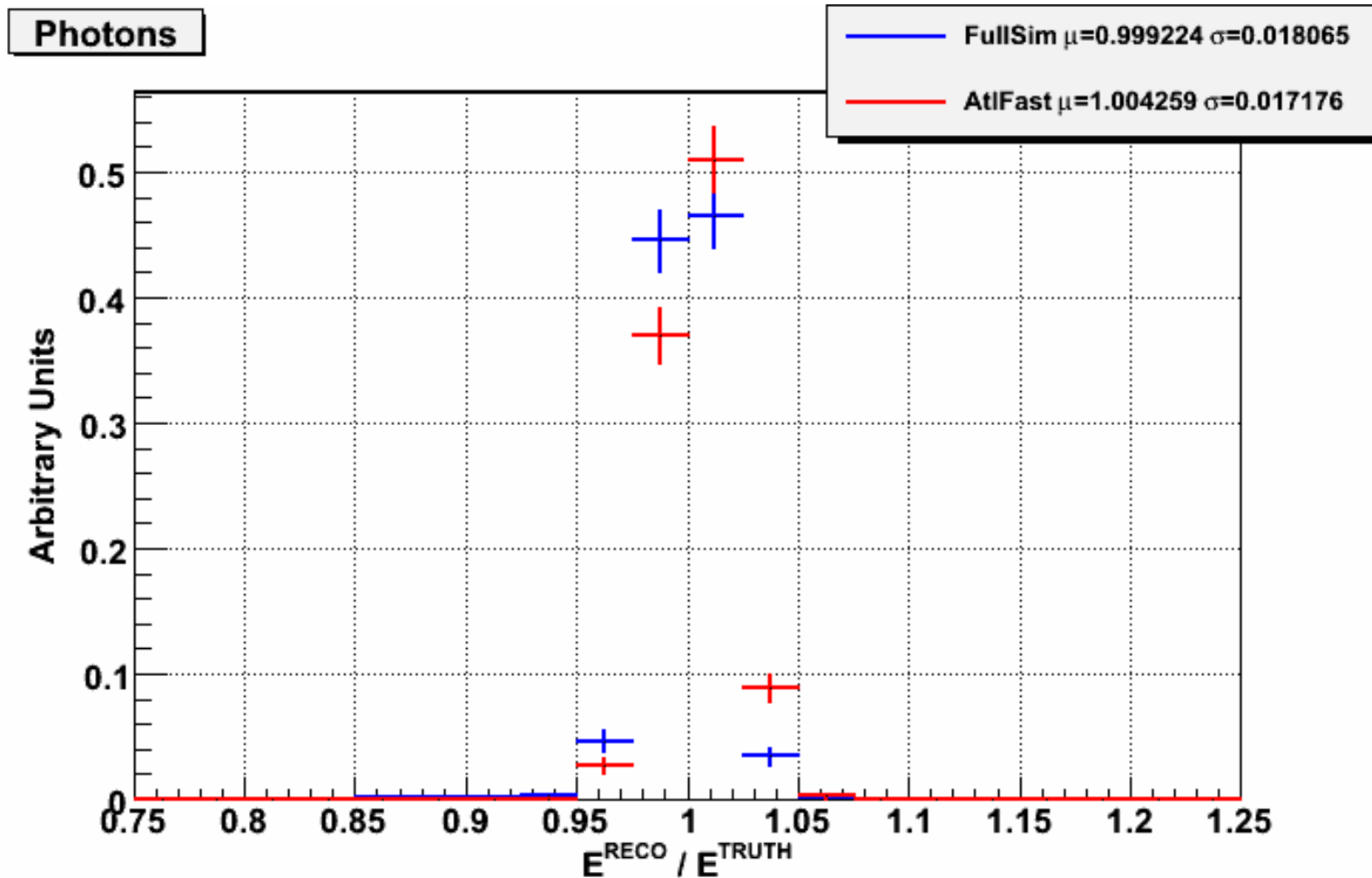# First validation of updated ATLFAST parameterization

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Validation strategy

- Use single particle RDO without calo. noise
  - reconstruct with default *and* FastCaloSim calorimeter cells
    - simulation and reconstruction in 14.2.20.3
    - new (Feb. 27) FastCaloSim parameterization from Matti Werner
  - Compare cluster variables, like:
    - total energy, position resolution
    - "PID" distributions (shower vars for e/γ; longitudinal fractions for π)
- Checking O(1k) parameterizations per species: (eventually) rely on automatic comparisons
  - Compare means, RMS, Kolmogorov test probability
  - For electrons/photons: monitor isEM() efficiency

Photon validation: energy

Photons

FullSim $\mu=0.999224$ $\sigma=0.018065$

AtlFast $\mu=1.004259$ $\sigma=0.017176$

50 GeV photons, $\eta\approx0.2$

E^{RECO} / E^{TRUTH}

Small but significant difference in mean photon energy

Photon validation: efficiency

- Used Matti's photon samples in 4 η-bins

| E	η	Geant4 tight eff (%)	FastCalo tight eff (%)
50	0.2	92.4 ± 1.0	86.6 ± 1.3
100	0.2	92.9 ± 0.9	79.2 ± 1.5
200	0.2	90.4 ± 1.3	79.2 ± 1.5
50	0.8	91.4 ± 1.5	89.2 ± 1.8
100	0.8	91.5 ± 1.8	91.9 ± 1.7
200	0.8	90.5 ± 1.8	89.1 ± 2.1
50	1.2	92.5 ± 1.6	86.8 ± 2.0
100	1.2	96.1 ± 1.2	98.6 ± 0.8
200	1.2	97.3 ± 1.1	96.3 ± 1.5
50	2.0	88.5 ± 1.9	84.9 ± 2.3
100	2.0	87.2 ± 2.0	84.6 ± 2.2
200	2.0	96.1 ± 1.2	87.4 ± 2.4

Overall: ATLFAST-II photons have low reconstruction efficiency …

Photon validation: shower

- Generally good agreement in longitudinal shapes
  - especially w.r.t egamma cuts
- efficiency difference is mostly due to *weta1* →
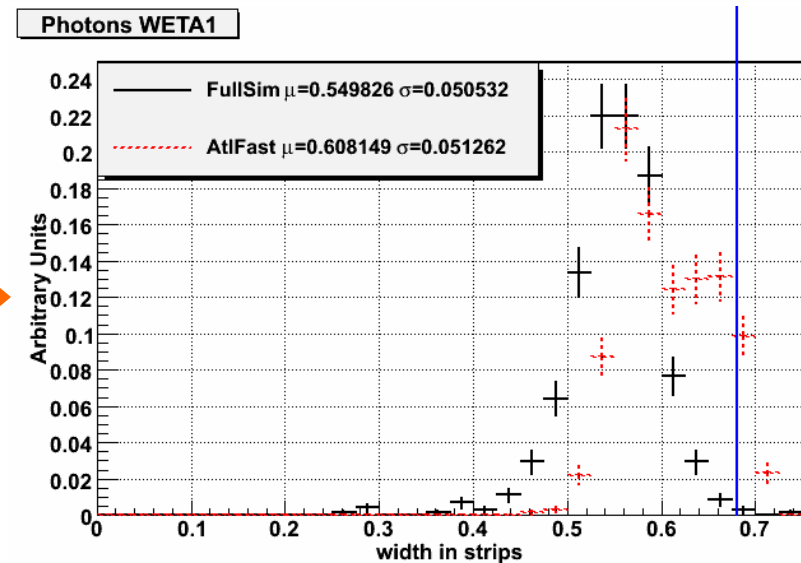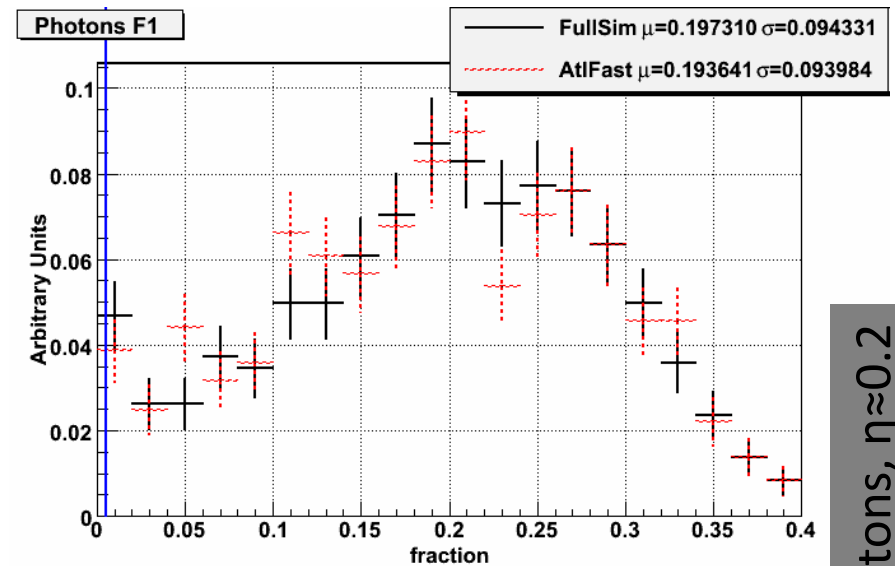
50 GeV photons, η≈0.2

Pion validation: overview

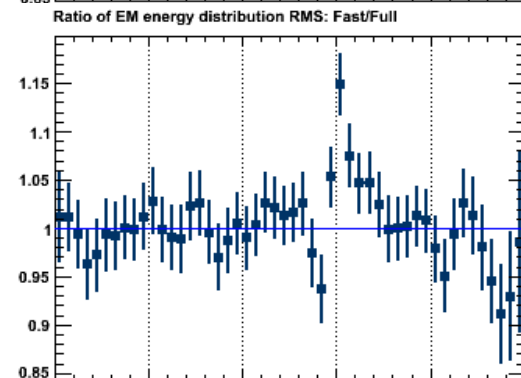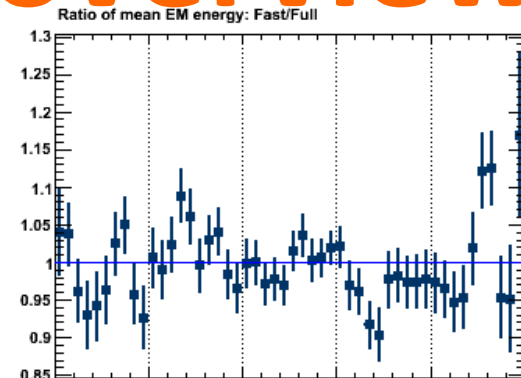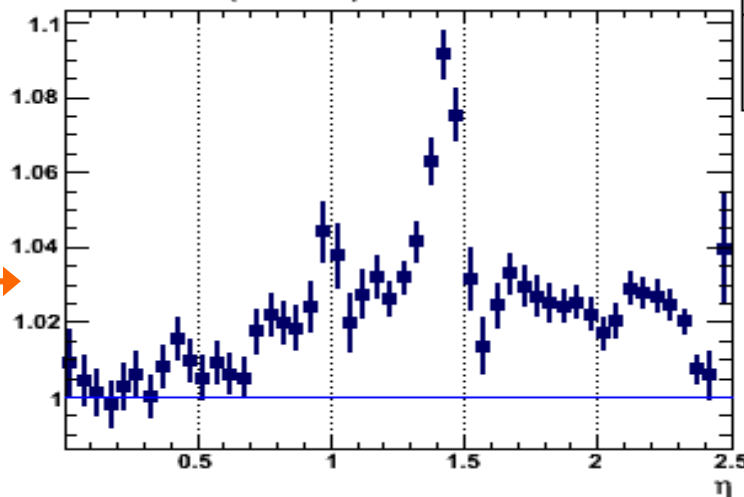- 100 GeV single π samples

- compare CombinedClusters

- ATLFAST-2 clusters: too energetic

  - better at low η

  - EM modeling is better, except in crack →

Ratio of means (fast/full): Cluster E

EMS	
Entries	50
Mean	1.256
RMS	0.7179
Underflow	0
Overflow	0

Ratio of mean EM energy: Fast/Full

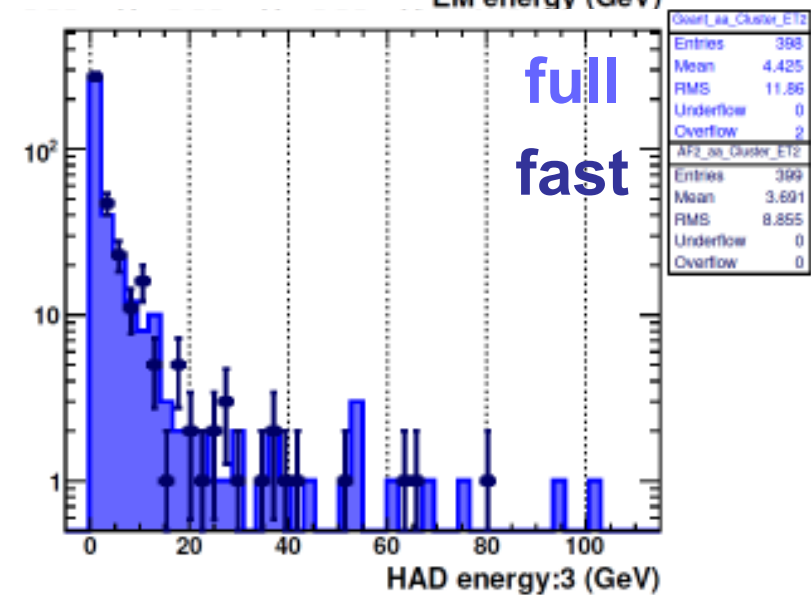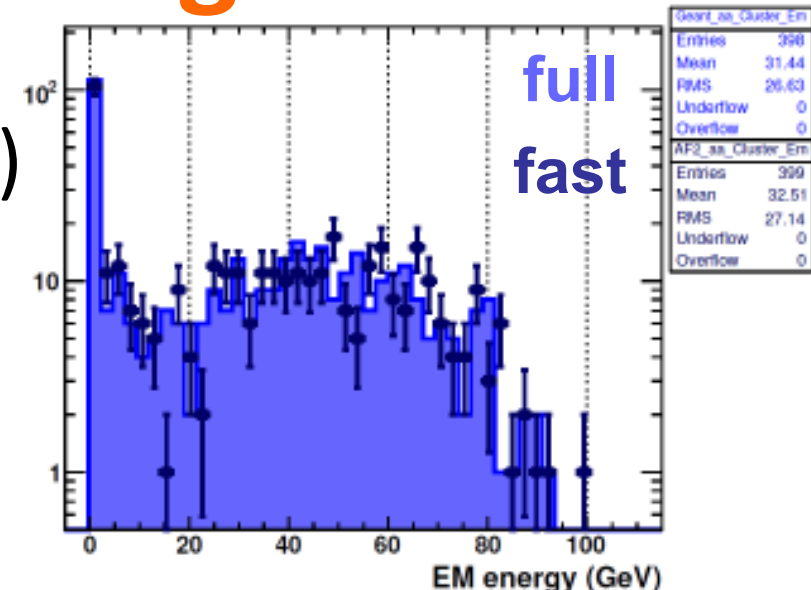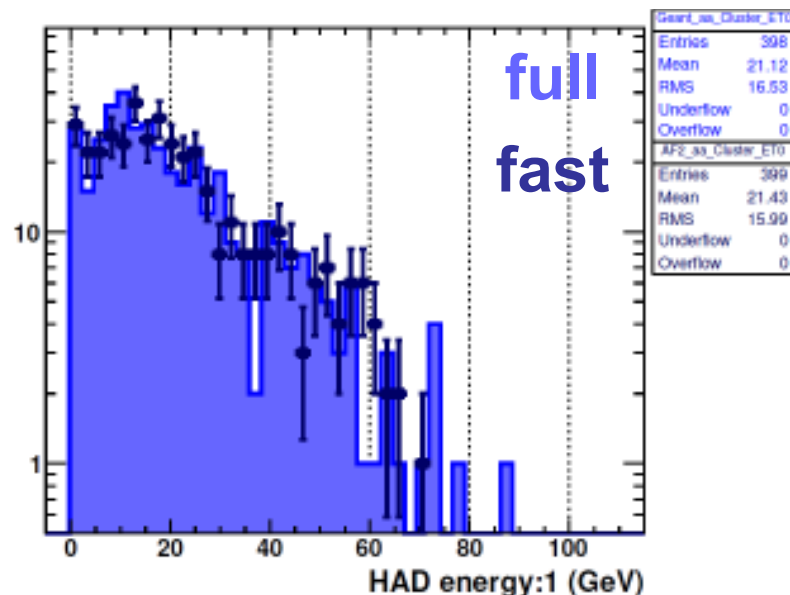Ratio of EM energy distribution RMS: Fast/Full

Kolmogorov test probability
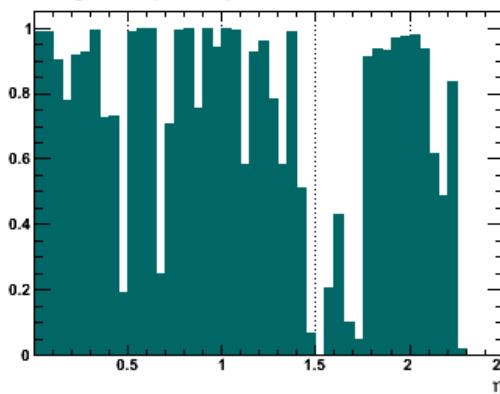
100 GeV pions

Pion validation: long. fractions

Example plots: (0<η<.05)

distributions well-modeled by parameterization

100 GeV pions

Conclusions/Next steps

- First parameterization set:
  - many points already quite good in longitudinal variables
  - lateral shapes for photons and pions both need fixing
- Automatic comparisons appear robust
- To do: continue simulating energy points for both photons and pions
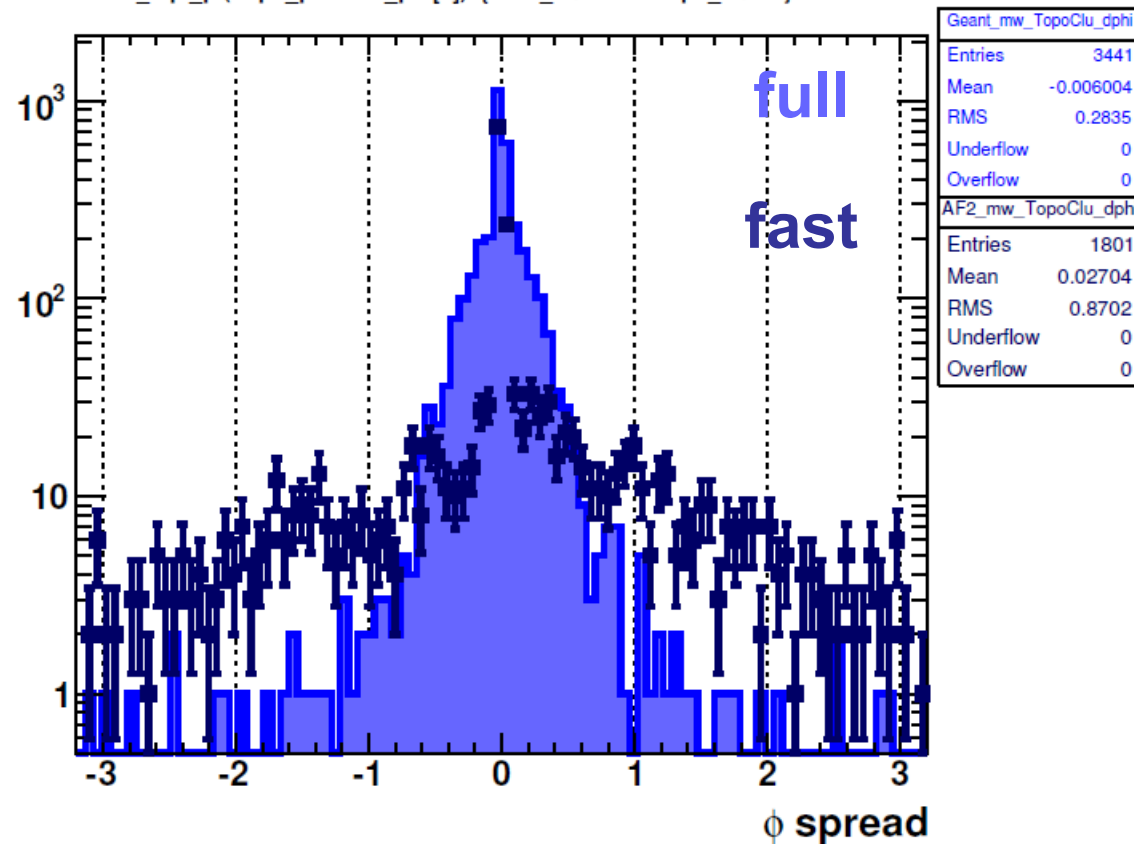 - combine batch/grid to check several energies per week
- To do: remake TopoClusters for pions
  - use these for future pion comparisons
 - add some global Calo variables for sanity checks

Backup: TopoClusters


TVector2::Phi_mpi_pi(Topo_phi-Gen_phi[0]) { Gen_N > 0 && Topo_N > 0 }

Geant_mw_TopoClu_dphi	
Entries	3441
Mean	-0.006004
RMS	0.2835
Underflow	0
Overflow	0

| AF2_mw_TopoClu_dphi	
Entries	1801
Mean	0.02704
RMS	0.8702
Underflow	0
Overflow	0

φ spread

- Big difference between Fast/Full! Fast has clusters *everywhere* in each event
  - FastCaloSim reco jobs had noise RMS=0, hence TopoCluster seed,neighbor thresholds = 0
  - FullSim reco. jobs had default noise thresholds
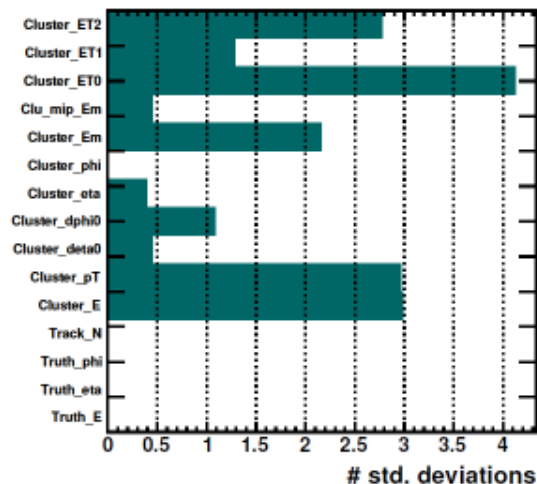- redoing reconstruction with the same thresholds before comparing

Backup: Problematic fit
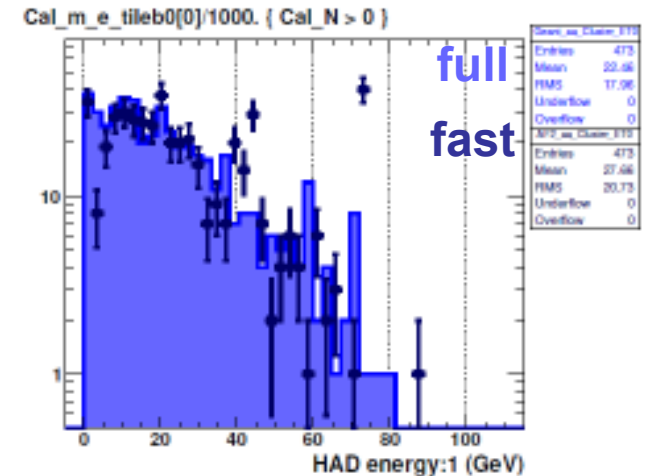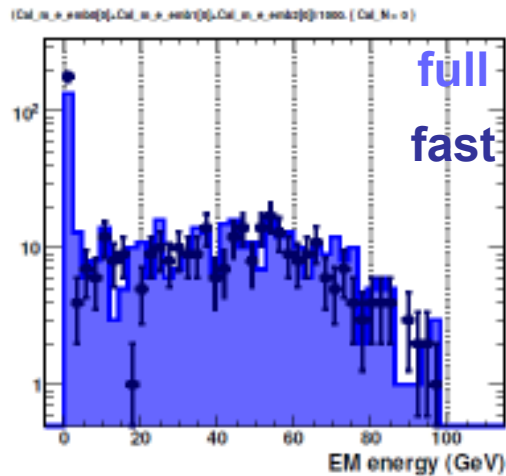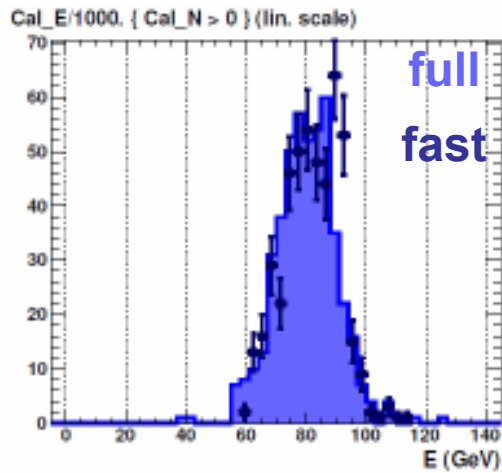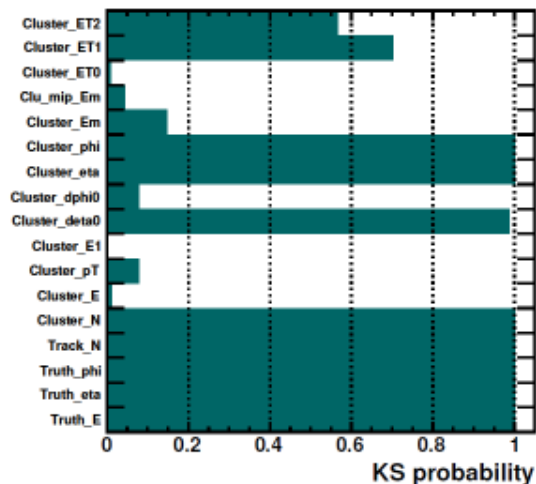
- flagged by automatic checks
- weird spikes in ATLFAST-II distributions